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Participatory Rural Appraisal in the Lowland Ecosystem of Selected Barangays in Misamis Occidental, Philippines

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Abstract

This document is the output of the Participatory Rural Appraisal (PRA) in the lowland ecosystem of Misamis Occidental and forms part of the Pre-Implementation Phase (PIP) of the Biodiversity Research Programme (BRP) for Mindanao: Focus on Mt. Malindang. Similar PRAs were also conducted in the coastal and upland ecosystems.

BRP is a collaborative research programme on biodiversity being undertaken in the Mt. Malindang environs in Misamis Occidental with financial support from the Netherlands government and with SEARCA acting as base institution.

A major objective of this work was to collect data from the chosen eleven barangays of the Lowland Ecosystem of Misamis Occidental through PRA to come up with research themes to be implemeted in the BRP. The PRA resulted in the characterization of the biophysical environment and the analysis of the socio-economic and cultural conditions

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The authors were the participants in the PRA conducted in the Lowland Ecosystem of Misamis Occ. during the Pre-Implementation Phase of the Biodiversity Research Programme (BRP) for Mindanao: Focus on Mt. Malindang, in 1999. The authors have complementary expertise in the physical and social sciences to be able to conduct a multidisciplinary approach to the biodiversity issue. They come from different academic institutions in Mindanao, namely: MSU- Iligan Institute of Technology, MSU-Marawi, Central Mindanao University, and Sultan Kudarat Polytechnic State College.

in the eleven barangays, namely: Landing and Lumipac in Baliangao; Dioyo and Sixto Velez in Sapang Dalaga; Unidos and Tipolo in Plaridel; Calaran, Dapacan Alto, Mamalad and Siloy in Calamba; and Sinampongan in Aloran. Two landscape and lifescape research themes have been formulated from the research data "Conserving Biodiversity 'Hotpots' in Mt. Amparo and Its Environs through Appropriate Land Use" and "Reversing Land Degradation Along the Langaran River." of the Biodiversity Research Programme (BRP) for Mindanao: Focus on Mt. Malindang.

Introduction

Mt. Malindang Range National Park is the sole representative forest area of the distinct biographical zone of the northwest Mindanao Island and at the northeastern tip of the Zamboanga Peninsula. It is located within the core of the Province of Misamis Occidental and declared as a national park through Republic Act No. 6266 on June 19, 1971. With a maximum elevation of 2404 m above sea level, it has a total land area of 53,226 hectares

This report presents the data gathered through participatory rural appraisal or PRA and their analysis. PRA is an approach and method for learning about rural life and conditions from, with and by rural people (Chambers, 1981). The objectives of the PRA in Misamis Occidental were twofold: (1) document and analyze data from the selected eleven barangays comprising the study sites of the lowland ecosystem of Misamis Occidental, and (2) identify researchable areas for the Philippine-Dutch Biodiversity Research Programme.

Methods

Using the map of Misamis Occidental, three transect lines based on the river and road systems were made; these lines started from the coastal to the upland ecosystems. Five municipalities and 26 barangays were intercepted from these lines. Four of these barangays interfaced with the coastal ecosystem and three with the upland ecosystem. A three-day field reconnaissance was conducted in the 26 barangays. A permit from the Provincial Governor was issued for this activity. The MAOs/PAOs also facilitated the ocular surveys. The researchers observed entry protocols for each barangay. Eleven barangays were chosen for the PRA based on the following criteria: pres-

ence of indigenous people (IPs), existence of economic, endemic or threatened biological resources, existence of people's organizations, barangay access to services, and willingness of LGUs to participate in the PRA..

The members of the Lowland PRA Team prepared checklists for biophysical, socio-economic, and cultural concerns, issues and opportunities to assess in the study sites making use of the following PRA methods:

Secondary Data Analysis. This refers to analysis of data, published or unpublished, pertaining to the study sites that have been gathered by other parties.

Participatory Mapping. This is a method designed to integrate the spatial information about the community. Village and land use maps were generated through the joint efforts of the community and the PRA team. Village maps were generally prepared using the perimeter boundary of the barangay and the road that runs through the center of the barangay as reference points. Village participants drew on the map the landmarks, houses, important buildings and trails. Land use maps were prepared using the base map; croplands, grasslands and forest lands were marked. The types of crops were identified on the croplands as well as the location of annual and perennial crops. The location of biologically and economically important plants, as well as water sources and drainage system, were also indicated. Figure 1 is an example of a village map prepared by local participants.

Transect Walks. Using the land use map prepared by the community, transect lines were drawn from either northeast or northwest direction based on the representativeness of the condition, like state of the resources, elevation, and settlement areas. The lines served as guides for observation walks of the PRA team and local participants headed by the barangay captains. The condition and uses of lands, as indicated in the maps, were confirmed or described further during the transect walk. Local names and uses of medicinal plants, problems related to land use, and other biophysical features traversed by the transect were also noted. Figure 2 shows one of the several transect maps drawn during the PRA..

Temporal Diagrams. These are graphic presentations of data on various conditions, issues and concerns. These include the timeline, product flows, and the seasonal and cropping calendar.

The ***timeline*** comprises the chronologies of significant events in the barangay, with approximate dates, that contributed to the loss of biodiversity like logging, kaingin, erosion, and flooding. Timelines were prepared by

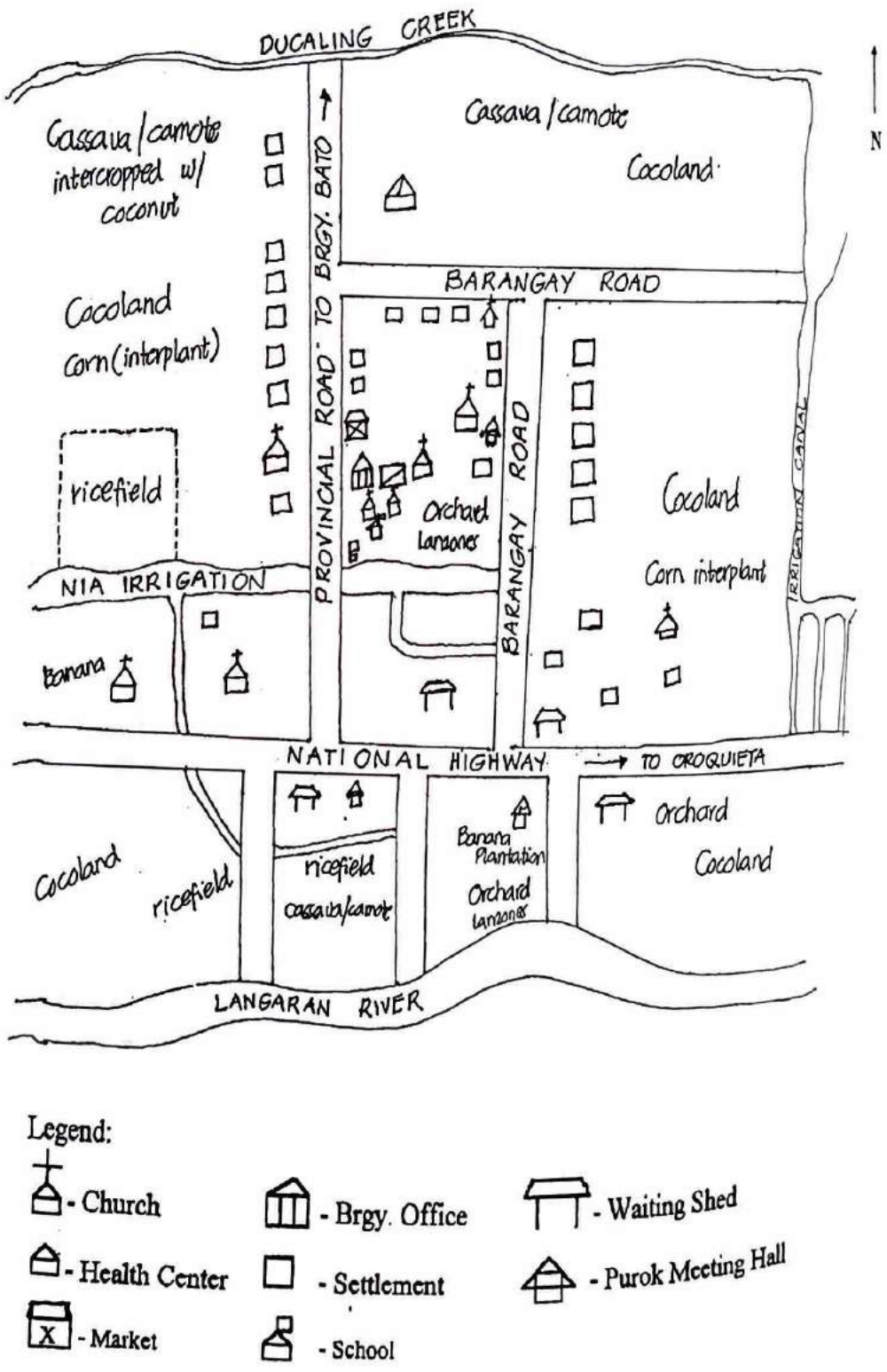

Figure 1. *Village and Land Use Map of Barangay Unidos Plaridel*

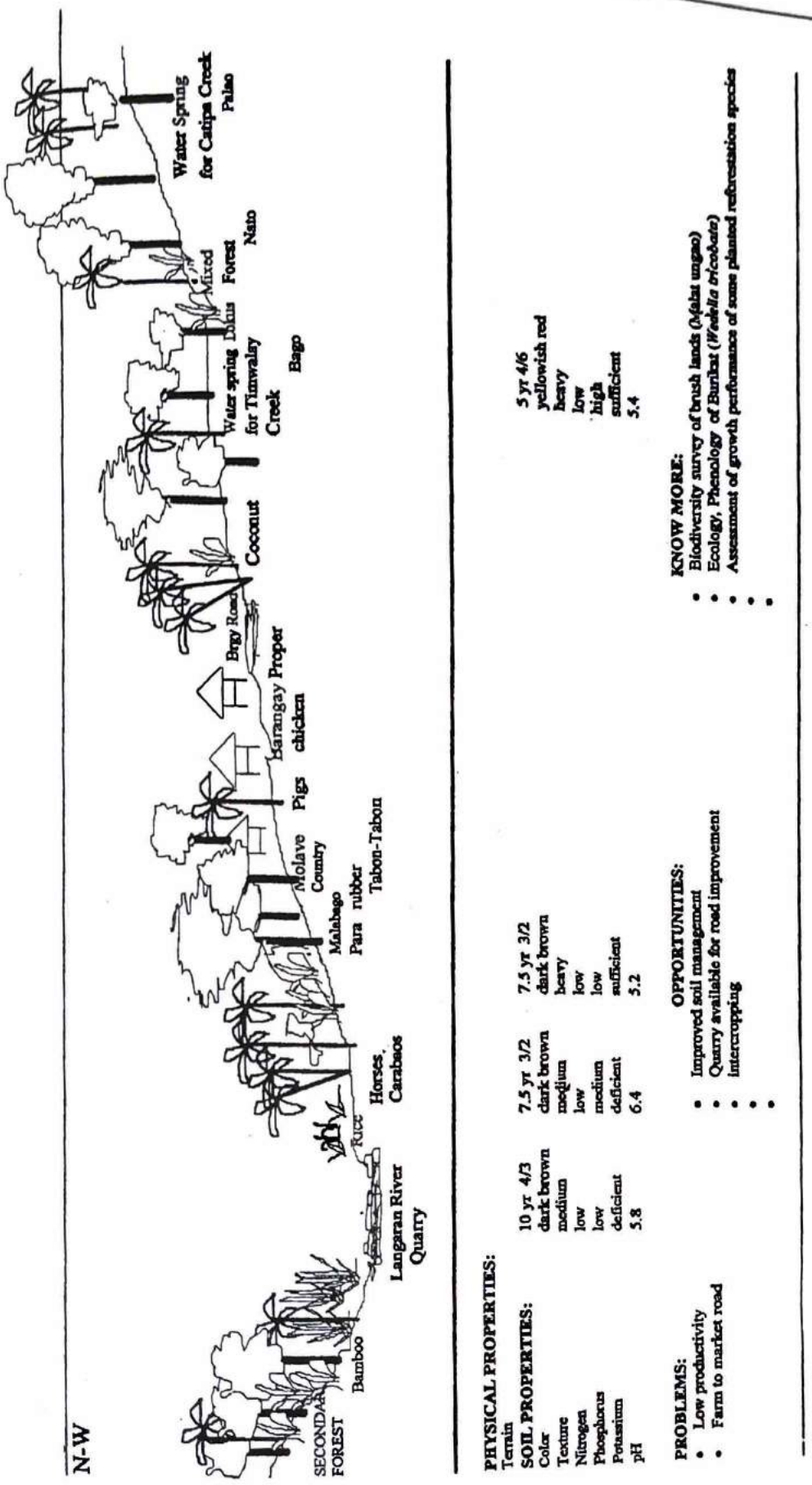

Figure 2. Transet Map of Barangay Mamalad, Calamba, Misamis Occ.

senior citizens and major informants together with LGU officials.

The ***product flow diagrams*** depicted the outward and inward flows of different agricultural, forest and industrial products in the barangays.

The ***seasonal and cropping calendars*** reflected monthly variations in specific activities or conditions, as well as rainfall pattern and phases of crop production processes of different crops. (Figure 3 shows a cropping calendar which also depicts gender relations in labor use in one of the barangays where the PRA was conducted.) Product flows or commodity flows (an example can be seen in Figure 4) and seasonal and cropping calendars were drawn from information obtained from the farmers and other major informants from the community in focus group discussions and semi-structured interviews.

Focus Group Discussions. These were discussions with a selected group of community members. Selection was on the basis of the community members' background and interest in the subject, and their knowledge relevant to the objectives of the discussions.

Semi-structured Interviews. This is regarded by some as the core of good PRA (Grandstaff and Grandstaff, 1987). This entailed having a mental or written checklist of what to ask, but being open-ended and following up on the unexpected.

Direct Observations. This is directly observing people, objects, events, processes or relationships and recording these mentally or in diagrammatic form. Some indicators were used to "see" other variables that were more difficult to observe, such as housetype as indicator of wealth.

Meetings and Workshops. These were conducted to orient the various stakeholders in the study sites about the BRP, PRA, preparation of the maps, validation of the maps and data collected.

Network Analysis. In this method the community members were asked to come up with a diagrammatic presentation of problems related to biodiversity and the environment. In this diagram the causes and effects of the problems were shown, thereby raising the awareness of the community on their plight and on the need for environmental protection and enhancement.

Community Validation Meeting. This was organized to validate the results/data collected during the PRA. It was attended by the municipal mayors, barangay captains heads of GOs and NGOs in the PRA sites. A general presentation of the results and researchable areas in the vernacular dialect was done. The visual aids (diagrams, village and land use maps, tables,

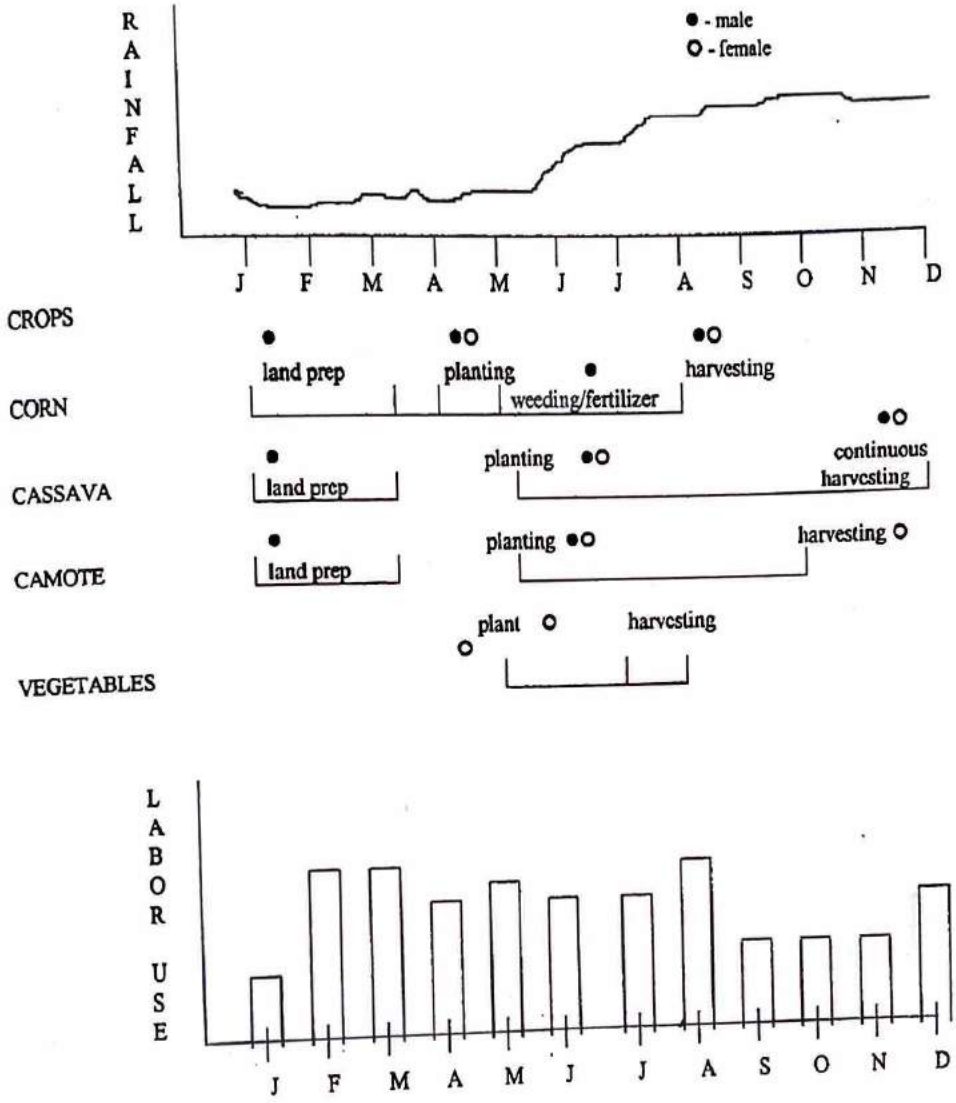

Figure 3. *Cropping Calendar and Gender Relations in Labor Use in Barangay Dapacan Alto, Calamba*

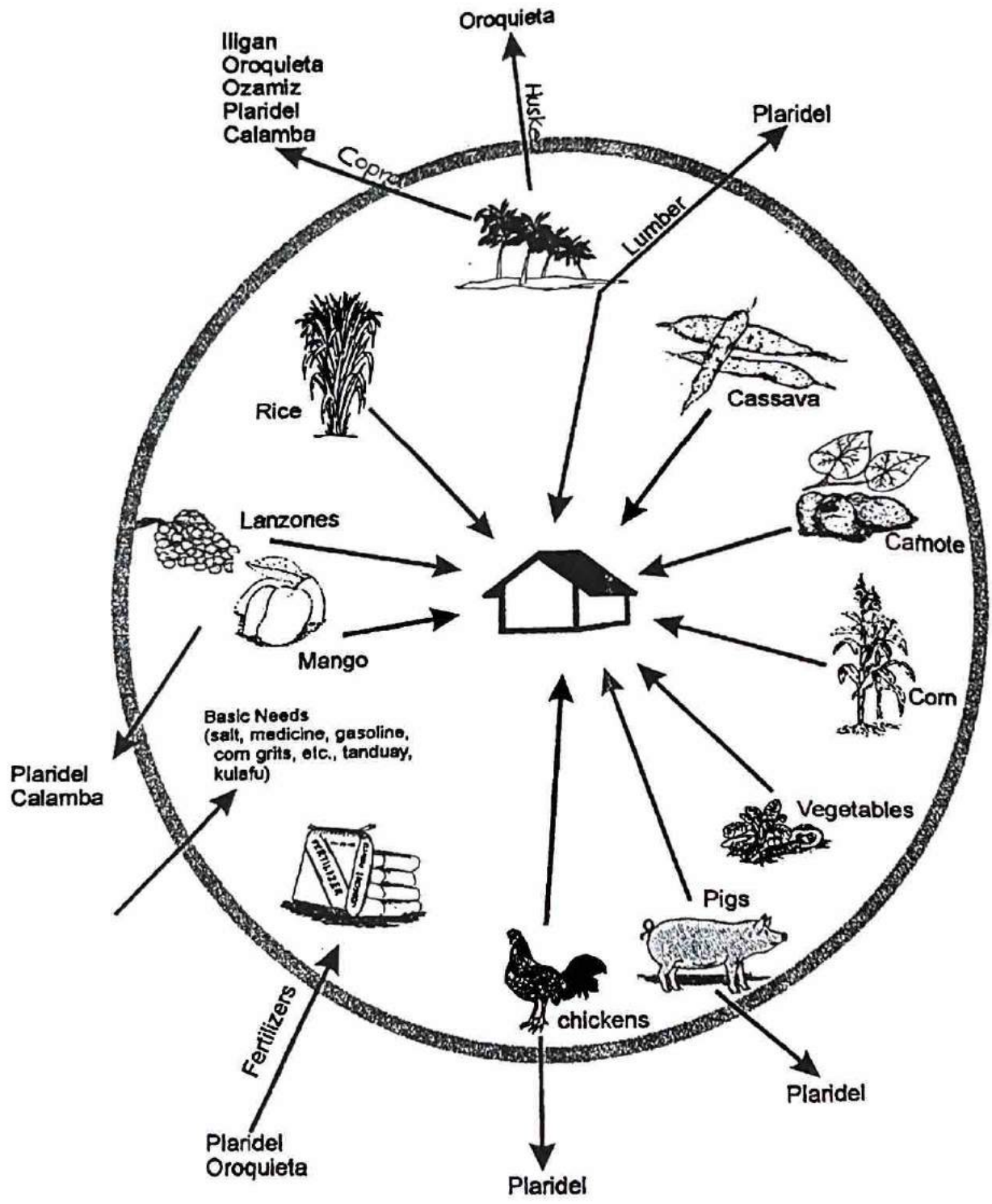

Figure 4. *Commodity Flow in Barangay Unidos, Plaridel*

graphs, etc.) used were those done by the local participants themselves or copied from their output. The local participants examined their output for correctness and made some comments and suggestions for revising those that do not capture the real situation.

General Features of the Study Area

Geographic Location of the Study Area and Accessibility

The lowland ecosystem of Mt. Malindang Range National Park under investigation lies within the coordinates123° 36' 45" to 123° 42' 54" east altitudes and 8° 27' 06" to 8° 37' 49" North latitudes with elevation ranging from 25 m above sea level (m asl) in Landing and as high as 610 m asl in Sinampongan.

Eleven barangays were chosen for the participatory rural appraisal (PRA). The barangays, which are predominantly farming communities, were grouped into three, based on their altitudinal range and on how they interface with the coastal and upland ecosystems. The first group was composed of four barangays (Landing, Dioyo, Unido, Tipolo) with altitude ranging from 25 to 65 m asl and interfacing with the coastal ecosystem as evidenced by the intrusion of salt water into the river. The second group of barangays (Lumipac, Calaran, Dapacan Alto and Mamalad) have altitudes ranging from 80 – 360 m asl, inland and without intrusion of salt water into the river. The third group was composed of three barangays (Sixto Velez, Siloy and Sinampongan) with altitudes ranging from 400 – 610 m asl, characterized by the presence of primary and secondary forests and interfacing with the upland ecosystem. The Langaran and Dioyo Rivers run through most of the barangays. Several creeks join these major rivers which eventually drain into the Murciellagus Bay.

The barangays are accessible on foot or by means of transportation from various entry points. A circumferential provincial road and feeder roads link these barangays to the coastal and upland barangays. Access to the upper parts of the range, like Siloy and Sinampongan, is provided by tracks and trails mostly following the upstream direction of its major drainage areas.

Discussions

Bio-Physical Environment

Physical Conditions

Slope/Topography. Group One barangays are generally flat to gently rolling. Inland barangays or those belonging to Group Two tend to be relatively flat to rolling while the higher elevation barangays or Group Three are generally rolling, rising gently and steeply towards the hilly rough rolling lands westward to Mt. Malindang and Mt. Amparo.

Soil Conditions. A total of 46 soil samples from major land use areas were collected and analyzed for pH, nitrogen (N), phosphorus (P) and potassium (K) using the soil Test Kit (STK). Physical characteristics like color, texture and erosion potential were also determined in the field. The soil analysis showed increasing acidity with increasing elevation and ruggedness of terrain. There is also a trend toward soil acidification in areas using high amounts of inorganic fertilizers. N is generally low particularly in barangays Lumipac, Tipolo, Calaran, Mamalad, Landing and Sinampongan. P is also low in barangays Lumipac, Dioyo, Calaran, Unidos, Dapacan Alto and Siloy while K is mostly sufficient except in barangays Dapacan Alto , Tipolo, Mamalad and Landing. The soil color is brown to dark brown and is getting yellower and redder with elevation. Soil texture is generally heavy (clay loam) except in a few near coastal barangays (Tipolo and Landing) where some soils are light to medium in texture. Soil erosion is serious along the Langaran River banks which are put into agriculture and where quarrying is left uncontrolled. It is also a problem in cultivated kaingin and in many marginal slopes that are put into cultivation without using appropriate farming technology.

Land Use Patterns. The eleven lowland ecosystem barangays studied have four major land uses namely: settlement, agriculture (includes abandoned areas which turned to brushlands), reforestation and secondary forest areas which also include brushlands. A fifth major land use, covering 54 hectares, is an Army Reservation area unique to barangay Tipolo, Plaridel. Agriculture occupies the largest segment (65% on the average) of the area with coconut as the number one crop followed by wetland rice, corn and root

crops. This is followed by settlement (15%), secondary forest (12%) and reforestation area (6%). (Percentages cited here are estimates given by key informants during the making of the resource map and the conduct of the transect walk). The reforestation area is dominated by mahogany and gmelina with mangium as a far third. The agricultural and the secondary forest areas also include abandoned or logged areas, formerly kaingin areas, which have turned to brushlands. The latter is dominated by malatungaw (*Melastoma Malabathricum*), cogon (*Imperata cylindrical*), talahib (*Crysopogan aciculatos*), and agsam (*Dicranopteris linearis*) which is very common in higher elevations), all indicators of poor soils. Although coconuts dominate the agricultural areas, there is now a significant reduction in coconut hectarage because the coconut has become a cheap alternative source of lumber. This has been aggravated by the development of irrigation facilities particularly in Groups One and Two barangays. In addition to coconut, the secondary forest is the main source of firewood and materials for house construction. It is also a source of various other materials, timber or non-timber (rattan, nito) which generate additional income for the family.

Climatic Conditions. The barangays studied fall under Type IV or Intermediate B type of the Corona System of Classification. This means that rainfall is more or less fairly distributed throughout the year. There is no pronounced dry season. The wet months are in November and December, the latter being the rainiest. Near-coastal barangays (Tipolo, Landing and Calaran) are dry in February to March while higher elevation barangays are dry in March to April. The latter is the driest month. The average annual rainfall is 1,911 mm (1998-1993 data, PAGASA). Relative humidity is 85-86% in the rainiest months and is 79 % in the driest month. The mean annual temperature is 27.7°C with 26.8°C as the lowest and 28.5°C as the highest (1951-1985 data, PAGASA). Cyclonic, northeast monsoon is the most prevalent wind system in the area occurring in November to February.

Physiographic Conditions. The eleven barangays are characterized by a flat to relatively flat to mildly rolling to rough and steep topography. Flat to relatively flat areas comprise about 50% of the whole study area. The land area per barangay varies considerably, the smallest area being 147 ha (Dioyo) and the biggest is 1500 ha (Sinampongan). The elevation ranges from 25 to 610 m asl.

Drainage and Major River Systems. The eleven barangays are drained by several rivers. The major river systems are the Langaran and Dioyo. The

Langaran River traverses through four barangays: Mamalad, Calaran, Unidos and Tipolo while the Dioyo River runs through four other barangays: Siloy, Dapacan Alto, Lumipac and Dioyo. Sixto Velez is drained by Tolon and Guinabot Rivers, Sinampongan by the Pines River while Landing drains to the Sinian River.

Transect. Transect lines were run for each of the 11 barangays. The transects ran from either northeast or northwest direction as indicated in the transect map. The following biophysical parameters were also included: soil, average percent slope, agricultural crops, trees and livestock. Eventually, problems and opportunities for each transect were identified.

Biological Conditions

In the early 1930s, most of the barangays were still densely forested with only a few patches of open grasslands. Dipterocarp species, such as white and red lauan, tanguile, yakal and other hardwood tree species used to grow in the forests of Dapacan Alto, Mamalad, Sixto Velez, Siloy and Sinampongan. Recently, however, only barangay Siloy and Sinampongan have patches of natural forest. These two forested barangays are still inhabited with some endangered, economic and primitive vascular plants like Kapa-kapa (*Medinilla magnifica*), whisk fern (*Psilotum complanatum*) and a fern ally (*Tmesipteris lanceolata*). The lives of these plants are highly threatened because of habitat destruction made by the local people. Twenty-nine endemic species and 86 economically important species were seen in PRA sites.

Wild animals including wild pigs, monkeys, deer, bats and various bird species used to be abundant in the forest. However, except for a few sightings of wild deer, monkeys and pigs in Siloy and Sinampongan, they have now disappeared due to over-hunting and habitat destruction. In all barangays studied, except for Sinampongan, the major crop is coconut. It is generally grown with corn, cassava and camote as intercrops except in Sixto Velez and most of Landing where it is a monocrop. In Tipolo, it is mainly intercropped with lanzones. It is basically sold as copra although some coconut farmers sell whole nuts. Rice and corn are the next major crops. Corn is generally for household consumption only and usually grown under coconuts. Barangays like Sixto Velez and Calaran grow it as a monocrop. Rice is grown in commercial scale and is a monocrop. It is watered by the irrigation system coming from the Nazareno Dam and the NIA.

High value fruits like mangosteen (*Garcinia mangostana*), lanzones (*Lansium domesticum*), mangoes (*Mangifera indica*) and marang banguhan (*Artocarpus adoratissima*) abound in many of the barangays. Plantations of mangoes and lanzones can be found in Calaran and Tipolo while mangosteen is found in Sixto Velez and Sinampongan. In some barangays, these fruits are grown only in backyard or planted together with other crops in small farm lots.

Vegetable gardens are becoming an increasing important feature of the landscape. High value vegetables such as carrots, ginger, bell pepper and pechay are grown and sold mainly for the market in Aloran. Eggplants, ampalaya (bitter melon) okra (ladies finger), squash and string beans are also grown commercially in Tipolo.

The incidence of pest and diseases problem has been observed, the most serious of which are tungro, green leaf hopper, black bug and rats in rice, corn borer, leaf miner and rats in coconuts and bunzalo problem in cooking banana. An age-old "pest problem" also continues to plague the coconut farmers: this is the theft of young and old nuts which also contributes to low yield and income.

Socio-Economic Analysis

Demography

Population. Population figures for 1998 in the eleven barangays ranged from 430 to 1824 or an average of 910 persons per barangay. Average household size is six. Males and females are generally proportionate in number, except in Tipolo, Dioyo and Landing. In Dioyo the male population is more than twice that of the females. Most of the members of the population belong to the 15-64 age bracket, or the prime working age group, except in Sinampongan where the 0-14 age bracket predominates, possibly because the barangay is the latest to become a settlement area among the study sites.

Population density and area elevation have been found to have an inverse relationship: the lower the elevation, as measured in meters above sea level (m asl), the higher the population density. This higher population density means more resource users and hence more biodiversity **loss.**

Fertility, Mortality Rate and Longevity. Fertility rates remained unchecked despite the introduction of family planning methods. The key informants said the number of children of married women reaching the age of 35 remained practically the same. This may be traceable to the general absence of conflict in farm work roles and family roles of married women. The decision or indecision regarding the number of children a family should have appeared to be directly related to work patterns in the farm which allows ample time for childrearing. The improved delivery of health services and increasing supply of potable water, meanwhile, has drastically reduced infant mortality and has increased the life span of adults. Longevity is 70 on the average, with women generally living longer than men by some ten years.

Out-Migration. Out-migration is quite common among young men and young women between the ages of 15 and 25. The proportion of migrating young women is increasing especially that they have stayed in school longer and therefore have higher chances to land in off-farm jobs in urban centers. The sizable out-migration rate due to limited employment opportunities in the study sites and in the province, plays an important role in keeping the population growth rate down and in preventing further reduction in biodiversity. The population growth rate of Misamis Occidental is reported by the NSO to be below 0.90% in 1998.

Health. The use of herbal medicine is a widespread practice in the eleven barangays where medicinal herbs are found in abundant quantities. There appears to be an herbal cure for any disease or illness in the community. Commercially-prepared drugs, however, are already also applied.

Common causes of illness or morbidity among children are diarrhea, respiratory diseases, measles and fever. Except for measles, this is also true for adults. Hypertension is also prevalent, and this is said to be due to the high-salt diet. Thyroid disorders have been observed in higher elevation areas, especially in Sinampongan where food rich in iodine is scarce.

Ethnicity. Consistent with secondary data, the Subanens, the original settlers in the province, are pushed into the interior with the coming of migrants. Subanens and their descendants constitute the bulk of the population, or about 70%, in Mamalad, Siloy and Sinampongan which are higher elevation areas. Boholanos, Siquijodnons and some Cebuanos and former residents of nearby Mindanao provinces, populate the flat areas.

Educational Attainment. Most people in the study sites have had some elementary education owing to the presence of public elementary school in

each barangay. Easier access to secondary schools, as when one is residing nearer cities and municipal centers, as well as relatively better economic standing, enable a considerable number to go to high school. Very few managed to reach or finish college. A considerable number has also taken vocational courses.

Young women generally spend more years in school since the young men are needed to help in the heavy workload in the farm. On the other hand, the limited off-farm employment opportunities in the barangays or in the nearby municipalities serve as a dis-incentive to pursue higher education.

Livelihood Activities

Subsistence agriculture remains high, claiming about 75% of total agricultural output. Coconut is the primary cash crop. While it is preferably sold as copra as this commands a better price, some sell the nut due to the low harvest which makes it uneconomical to produce copra. Others sell the nut due to the non-ownership of a landahan or dryer. A solar dryer, however, is now available in every barangay. The staples are the next major crops. A marketable surplus of the staples is induced by the need for cash income to survive in the increasingly commercialized agricultural scene. As corn is rain-fed, it is grown in larger quantities. Rice is grown in areas with access to irrigation facilities, such as Tipolo and Unidos. Cassava and root crops are also grown to supplement the diet, and a surplus is being produced for the market. Livestock is also raised in the backyard to help meet the household needs.

In near-coastal and coastal areas, fishing activities co-exist with farming, together with the growing of high value fruit trees as lanzones, mango and mangosteen. Banana is also widely grown. More off-farm income opportunities as factory employment, employment in the service and construction sectors, trading, quarrying and nipa production are also found in these areas. In higher elevation and forested areas as Sinampongan, the growing of high value vegetables of the semi-temperate variety as carrots, ginger, petchay, and bell pepper for the market is common.

As cash income is depressed by middlemen who dictate prices, by poor farm-to-market roads, by lack of transportation and the distance to the market, the rural poor turn to forests to cut trees or to gather rattan without replanting. The trees are for fuel wood or for timber, and together with rattan,

they are sold to augment income. Poverty thus impinges on biodiversity conservation and enhancement.

Labor Force Availability

As indicated by the age structure of the lowland population in the study sites, labor is abundant and matches the requirements of subsistence farming. Family labor remains the most prevalent and informants have reported intra-family equity. This means that both men and women work in the farm, just as both work at home, with the men responsible for heavier loads in the farm, and the women doing most of the housework. As all able family members work in the small farmlot, a zero marginal productivity for some members is implied. Hired labor ranks next and earns a low daily wage rate of P80. Hunglos or labor exchange, commonly practiced in the past to overcome the limitations of the subsistence farmer to pay for hired labor, is now only a far third as the rural communities are increasingly drawn into the cash economy.

In the flatter areas where a greater proportion of agricultural products are being grown for the market, as in Tipolo, women rarely work in the farm as higher cash incomes make it affordable to hire labor. This shows that the married women's supply of farm labor depends on how far their families depart from their subsistence requirements.

Labor in the farm is underemployed for most of the year. It is only during seasonal peak periods such as during planting and harvesting when most find employment.

Level of Living and Income

The Minimum Basic Needs surveys conducted in the study sites by DSWD in 1998 point to very low incomes of less than P3,000 per month for most household with six members. The low farm productivity, underemployment of farm labor and the lack or absence of financial capital to start even the most basic entrepreneurial activities can explain this. Generally, poverty incidence increases as the area elevation increases. Poorer soil quality, too much rainful, lesser off-farm job opportunities and the farther distance from the market have been identified as major reasons for this trend.

Houses are commonly of light materials made of timber from the forests,

with G.I. sheet roofing but without ceilings, affording the residents very little protection from the heat of the sun at daytime or from the cold mountain breeze in the evening. Water supply is usually classified as Level I and Level II in the higher areas while Level II and Level III classifications co-exist in the lower areas. Barangay Sinampongan has no access to electricity. On the other hand, while electrification has already reached Siloy, only a few households have electric power. These are those which are nearer to the electric posts.

The water-sealed toilet is already widely used in the lower elevation barangays. While this is likewise found in the higher elevations, problems associated with water supply render the toilet bowl useless. The *antipolo* system is thus the more practical toilet system in most communities.

Commodity Flows

Copra is the prime commodity that flows out of the barangays. It is generally brought to the market through the middlemen or comprador. The coconut farmers rely on the comprador, who dictates prices, as they are usually unable to sell copra directly to the coconut oil mills due to the lack of transportation facilities in the barangays and the poor farm-to-market roads. Copra is brought to Oroquita, Ozamis, Iligan, and Cagayan de Oro.

Rice is generally a subsistence item; most communities – except where there is irrigation such as Tipolo, Calaran and Unidos – even purchase rice from the poblacion market. Among the barangays with access to irrigation, only 20 to 30% of rice production find its way to the poblacion market.

Only about 10 to 20% of corn production is sold as shelled corn in the poblacion market or to the cities of Oroquita and Ozamiz. There no self-sufficiency in this staple as the barangays purchase corn grits from their respective poblacion markets.

Among the high value fruits mangosteen and lanzones are the ones sold in large quantities, or about 80% of the harvest, reaching as far as Cagayan de Oro, Iligan and Cebu. Mangoes and marang are other high value fruits sold in sizable quantities, or up to 60% of produce. These are sold to Calamba, Ozamis and Iligan. High value vegetables of the semi-temperate variety such as carrots, ginger, bell pepper and pechay which are grown in Sinampongan, are mainly grown for the market. Similar to copra, compradors buy these

high value fruits and vegetables at low prices and sell these to nearby cities. Tipolo sells eggplants, ampalaya, squash and string beans to Calamba. Cassava, gabi, camote and bananas are also being sold, although in very small quantities to Calamba, Ozamiz, and Oroquita. Occasionally, as when there are contingency or emergency needs to be met, livestock is sold to the market nearest the barangay.

The small marketable surplus enables the farmer to earn cash incomes with which to pay for non-farm products to support consumption or to improve his farm. As this cash income is meager, commodity flows from outside the barangays are limited to the basic goods: salt, spices, kerosene, sugar, rice, and corn; clothing, materials for household construction and repair as G.I. sheets and nails; fertilizers, pesticides, seedling and simple farm implements. There is also a sizable and steady inflow of "sin" goods like the cheaper brands of cigarettes and alcoholic drinks.

Land Tenure and Landholdings

Most farmers are owners of very small farmlots ranging from one-fourth to one-half hectare in size. Several have farmlots up to two hectares. Farm ownership is mainly by inheritance. Several tenants in the Agrarian Reform Communities such as Siloy, Sinampongan, Unidos, and Landing have become landowners of redistributed lands which are generally 1.9 to 3.0 hectares in size. Three hectares is the maximum land area allowable to CARP beneficiaries. One-third of the produce of tenanted land goes to the farmers in rice and corn lands. In cocolands, the tenants get 100% of the yield of crops planted under the coconuts. There are a few leasees. There are also isolated cases of "ulos" or borrowing lands for cultivation; the owners, however, reserve the right to take these lands back when needed.

Governmental and Non-governmental Assistance

To meet the rising food and income requirements of the growing population, the government has introduced high yielding varieties of rice, corn, and coconut. These new varieties, however, are fertilizer-dependent and require more man-hours of work. While there is expressed willingness to adopt these technologies, the ability to do so is another issue. Majority of the people in the study sites simply do not possess the necessary funds to participate in

and/or sustain the innovative undertakings. The innovations are feasible only to those with sizable land and money, with easy access to credit and the market, or to those able to avail of limited government assistance. This exacerbates existing rural inequities: the richer farmers get higher incomes resulting from bountiful harvests while the poor farmers become even poorer with the cumulative reductions in farm productivity due to their inability to replace lost soil nutrients.

The government has constructed some feeder roads for easier market access and has built communal irrigation canals in some barangays. Investments in human capital as non-formal education and skills training for livelihood, and the provision for health facilities and services have been done, although to a limited extent, by both the DSWD and the DOH. The DSWD's package of assistance includes creation of day care centers and the organizing of RICs and Women's Clubs which ensure maximum partcipation in the livelihood and welfare activities in the barangays. Some barangays, namely Lumipac, Calaran, Siloy, and Unidos, have been classified as CIDSS (Comprehensive Integrated Development for Social Services) areas where 25 beneficiaries at a time from the selected barangays receive credit assistance for livelihood activities. Repayment problems have been reported, however, as the borrowers failed to plow back into their micro-investments a portion of profits earned. Beneficiaries said that the small profits earned are used to augment the meager income from the farm to meet consumption needs.

Artificial insemination was introduced by the Philippine Carabao Center to address the problem of decreasing draft animals. The DA, in addition to granting technical assistance in the farms, is doing animal dispersal. The PCA grants a four-year fertilizer subsidy to the small coconut farmer growing the high yielding variety. The DENR meanwhile engages in social reforestation in an effort to simultaneously attempt to replace trees cut for timber and fuel and to provide livelihood assistance as the reforestation species are fast growing and face a high market demand.

However, government assistance projects remain limited owing to the scarcity of funds and results in rationing or site selection. Some projects have unintended effects due to the beneficiaries' lack of education/information. A case in point is the poisoning of the irrigation canal in one barangay as beneficiaries of pesticides frequently washed pesticide containers there. This has reportedly caused the illness and even death of draft animals which drank from the creek serving as catchment to the irrigation spill in the neigh-

boring barangay of Lumipac.

Non-governmental assistance is demonstrated by the Foundation for Philippine Environment (FPE) and the PIPULI Foundation, Inc. Both are into environmental concerns, teaching appropriate and adaptive agricultural techniques such as the Sloping Agricultural Land Technology or SALT in Sinampongan. FPE-PIPULI also engages in community development programs to change the institutional basis of rural community life. Cooperative development is one such attempt, also in Sinampongan, to encourage self-help through livelihood activities. Start-up funds are loaned out to groups, repayable in tree planting – a kind of debt-for-nature swap; the higher the amount of loan, the larger the quantity of trees to be replanted.

Foreign assistance to government is granted by the European Union, making possible the formation of the EU-NIPAP and the funding and establishment of protected areas. In the study sites, Siloy and Sinampongan have been declared as protected areas.

Oral History or Timeline

The oral histories or timelines of each barangay have been collated to come up with the following general historical account of the lowland ecosystem, with focus on biodiversity:

1890s. The lowland barangays were heavily forested up to the 1890s, with only the migratory farming activities of the few IPs encroaching on the forests. The coming of the in-migrants from the Visayan islands of Bohol and Siquijor changed the environmental landscape. Subanens were progressively pushed to the interior as in-migrants in search of land arrived by batches. Kaingin was done in the interior areas by Subanens while the migrant settlers clear lands nearer the coast for settlements and for farming, particularly rice and corn. They also cut trees to build houses.

1930s. The introduction of coconut as a cash crop in the 1930s became an inducement to clear more lands to plant coconuts. High value fruits as lanzones, mango, nangka and mangosteen were also planted in response to the growing demand for them. The commercialization of agriculture was well underway during this period.

1960s – 1970s. Towards the late 1960s and into the 1970s there was an intensification of coconut planting, brought about by a high demand for copra. This again resulted in the clearing of remaining patches of forestlands.

The granting of logging concessions resulted in further environmental degradation. During this period there was also the intensification of rice and corn farming of the high-yielding varieties to meet food requirements of the growing population. This resulted in monoculture and decreased biodiversity. The newer staple varieties were, however, heavily dependent on inorganic fertilizers and more easily attacked by pest and diseases. To hedge against pest infestation the farmers had to plant sturdier crops as camote and cassava to serve as food supplements. These rootcrops were also found to withstand bad weather and required no fertilizers. During this period the farmers likewise started raising livestock in the backyard to help meet the household needs.

During this period also, the effects of deforestation started to be felt – erosion and flooding have become a continuing feature of community life.

1980s. Efforts aimed at attaining sustainable forestry practices have led to the development of rapidly growing species of trees as gmelina, mahogany and falcatta. These fast-growing trees are attractive alternatives because after a period of about six to seven years they could be harvested and sold. Replanting could then easily and cheaply be done. So, in the 1980's, social reforestation, also called plantation forestry, became the response to deforestation. This did not only try to curb problems associated with erosion and flooding but also served as a means of livelihood. But the single species-type of reforestation was a poor substitute to lost wildlife habitat such that the lowering of biodiversity continued. Meanwhile, ricelands were converted to coconut plantations due to the increasing demand for copra.

1990s. The 1990s saw an increasing awareness toward environmental rehabilitation and conservation. Integrated Pest Management or IPM was introduced through farm modeling by the DA during this period. It was also during this period that the presence of non-governmental organizations and people's organizations active in environmental issues, such as the Foundation for the Philippine Environment (FPE) and PIPULI Foundation, have started to be felt in the study sites. In 1994 Sinampongan and Siloy became protected areas. In 1996, PIPULI introduced the Sloping Agriculture Land Technology or SALT in Sinampongan. Throughout the period, the revival of organic farming methods in all the study sites was encouraged. Finally, as the decade was coming to an end and a new millennium was forthcoming, biodiversity conservation campaigns have been been launched.

Network Analysis

Each of the eleven barangays, through the key informants and community representatives, were asked to analyze their basic problems making use of the network analysis. The method was deeply appreciated by the barangay folks who said that it did not only allow some information to surface but had in fact increased their awareness on their concrete conditions. It even provided them a guide to action to improve their lot.

Integrating all the network analyses that were done, the lowland team has come up with a general analysis of the lowland areas where the PRA was conducted.

Invariably, low farm productivity resulting in low farm income or poverty emerged as the primary problem in the barangays studied (Fig. 5). Low productivity was seen as a result of infertile soil on one hand, and poor farming techniques on the other. Attempts to increase or at least sustain yields, given small farm sizes, resulted in continuous cropping rather than rotations, thereby worsening soil infertility. The poor soil quality could have been remedied by the application of fertilizers – organic or inorganic. The general preference was to apply inorganic fertilizer as it was less labor-intensive. Its application, however, was constrained by the inability to purchase the inorganic fertilizer owing to the lack of funds which in turn was due to both the low farm productivity and the near-absence of non-farm sources of income. The lack of financial assistance from institutional sources to purchase fertilizer was also pinpointed as a problem but not among small coco farmers who enjoyed a four-year fertilizer subsidy from the government.

Another reason cited for low farm yield was the poor farming techniques, which included primarily the inability to combat pests and diseases. Pest infestations in recent years resulted in the application of pesticides. While DA introduced IPM, only a few had adopted it. The communities felt that the government was too slow in delivering the necessary technical assistance other than IPM. Meanwhile, there was already the growing concern about pesticides contaminating water supplies, rendering them unfit for draft animals to drink and for fish populations to survive.

Low farm productivity was also seen as resulting from climatic changes, erosion, and flooding which the communities acknowledged to be due to deforestation.

While the benefits of the forests such as watershed maintenance, protec-

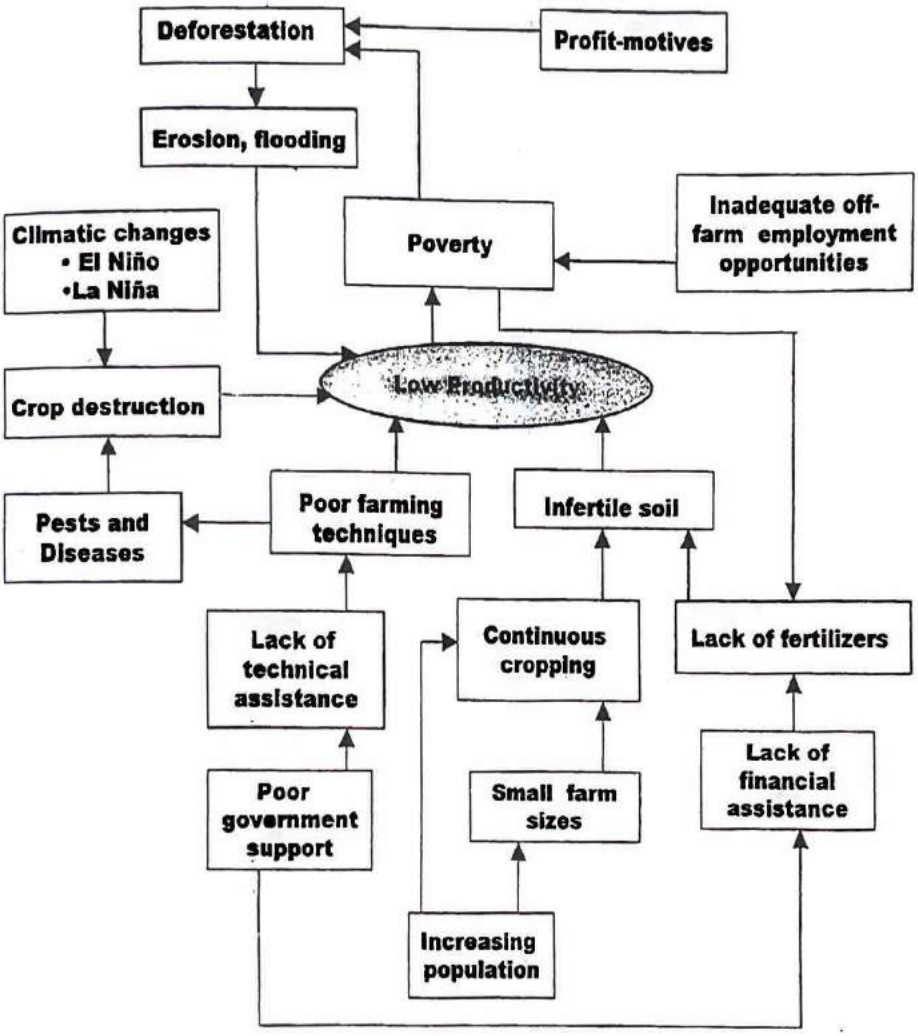

Figure 5. Network Analysis, Lowland Ecosytem

tion of wildlife, and prevention of erosion did not escape the farmers' awareness, the farmers lament sadly that not using the forest was to their disadvantage. This was because others cut down the trees that they tried to conserve; others likewise cleared forested lands that they left uncleared. This was because of the free access to the forest by just anyone before the establishment of the protected areas. For as long as forest resources were abundant, it was simply a matter of who staked his or her claim first.

Deeper analysis suggests that the concept of externalities serves to provide a reason for deforestation activities *vis-à-vis* declared awareness of forest conservation. Biodiversity benefits, soil erosion, damage to rivers and streams due to siltation and sedimentation are not borne by the farmers living near the forests and can be felt only by the people living downstream. Meanwhile, the cost of preventing deforestation is largely borne by them: stopping deforestation would mean giving up the jobs and income derived from cutting the trees or from harvesting other forest resources, or from farming the land cleared from the forest.

Cultural Setting

Indigenous Beliefs and Farmer's Traditionalism

Interviews with the barangay inhabitants revealed that their indigenous beliefs and rituals guide most of their farming practices. They still practice the"lihi" (an injunction to start any activity) which were deeply rooted in the culture of the inhabitants.

Rituals are also conducted by some farmers to drive away the evil spirit in their fields, including the pests and diseases that may attack their crops. Rituals are conducted during the planting time and also upon harvesting their crops in the form of ceremonies and offerings in the field.

On the whole, traditional beliefs influenced agricultural practices. A large number of farmers felt that shifting to new technology would mean more resources and will also entail adjustments away from their culture. Their biological farming and agriculture practices are highly supportive of principles of conservation of the environment and biological resources.

Since majority of these farmers owned only small farms and produced crops mainly for family subsistence, they hardly do postharvest practices

involving storage, except for seeds purposes. These seeds are usually hanged in areas near the kitchen stove to avoid being damaged by corn weevils and other corn pests. Drying is done through exposure to the sun while milling corn is performed using the "galingan" (stone corn grinder).

Decision-Making Pattern

Decision-making in the selected sites is largely familial but neither paternalistic nor maternalistic. Decision-making is neither the monopoly of the husband nor of the wife. Most of the decisions are made by both of them in borrowing money, celebrating special occasions, children's education, sale of property and marriage of children. The husband slightly predominate when it comes to the development of the land and having other sources of income. On the other hand, the wife predominates in the preparation of food, caring of the sick, and in buying household items.

Traditional Forms of Labor and Sharing

There is heavy dependence on labor supplied by family members, both in farming and non-farming activities. Traditional forms of labor arrangements are still practiced in communities not largely drawn into the cash economy. These include the "alayon" (communal farming); "hunglos" (labor exchange); and the "pahina" and "tampuhay" which have similar patterns as that of the bayanihan. In all these forms, no payment or remunerations are involved.

Local and Tribal Leadership Patterns

As far as village leadership pattern is concerned, the barangay captain and the Timoay (Subanen leader) possess strong influences on the people in terms of problem-solving, conflict-resolution, and goal formulation and achievement. As far as authority or political system was concerned, the barangay captain is looked up to; however, along patterns/structures associated with beliefs, values, and kinship ties, the "Timoay" of the Subanen tribe holds the rein of leadership in the community.

The barangay council is recognized in all community affairs and activi-

ties. Through the council, the projects and activities of different government agencies are carried out. Some elders of the barangay council also help resolve domestic conflicts, along with the "Lupon" which is headed by the barangay captain.

In the traditional Subanen society, the village is headed by a "gukom" (headmen). He is considered an influential person by virtue of his wisdom, wealth, and abilities not possessed by an ordinary person. He enjoys the respect of the village people. However, among the lowland Subanen, the term "Timoay" is more popular than the term "gukom". The word "Timoay" means chief or leader and it connotes both civil and religious authority on the person.

Conflict Resolution in Tribal Organizations

Conflicts rooted from customary laws, traditions, and culture of the Subanen are first presented to the "gukom". When the problem involved the barangay, the "gukom" convenes the Subanen Council of Elders. When the conflict covers a wider jurisdiction, the house of Timoays is convened. In both cases, the members with the "gukom" conduct the investigation. The members of the Council of Elders submit to the "gukom" their finding of the investigation including the amount of money the offender shall pay. The decision of the "gukom" for resolution usually involves stealing, quarrels, conflicts involving property and land and domestic disputes. Conflicts on land resources were usually related to access, ownership, or boundary issues and use. Access conflicts were related to competition on who could get to a particular resource when access was not well-defined by strong property rights but by assumed understanding.

Community Organizations

Community organizations serve as conduits for community expression and actions and were good training grounds for local leadership in solving problems and conflicts. Some of their actions were expressions of their interests in civic responsibilities in the locality, such as building a road, a water tank/reservoir, or a cooperative store.

Aspirations of People in the Villages

The aspirations of the indigenous people of Mt. Malindang are actually very simple. They aspire for an improvement, however meager, over their present status. Having many children, eating three meals a day, buying a carabao, and being able to travel to other places, are among their simple aspirations. Others have high aspiration for their children but poverty poses a great obstacle to them.

Awareness of Conservation Laws and Practices

Most of the inhabitants in the selected barangays are aware of the various laws and policies related to biodiversity conservation. Any violation of these policies is actually rooted in their impoverished condition and their desire to survive. However, a few of them are fully aware of the need to conserve biodiversity to avoid future calamities and enjoy sustainable livelihoods.

Some Problems, Opportunities and Researchable Areas

A. Researchable Areas in the Sub-ecosystems

Agricultural Sub-ecosystem. Mangosteen, mangoes and lanzones are major high value fruits in the area. Except for mangoes, these fruits are resistant to pest, diseases, shading and climatic changes. Micropropagation and other horticultural techniques are necessary to mass propagate these high value fruits to support and promote livelihood endeavors. These will serve as important support activities to the Biodiversity Research Programme.

Settlement Sub-ecosystem. The Langaran River offers a vast resource to sustain efforts at maintaining an ideal environment for both plant and animal life as this river drains to various areas surrounding the Mt. Malindang range. As this river cuts across areas, it supplies the much needed water to sustain life in these sectors. However, the river has been the object of activities that do not sustain its capability to maintain the existence of aquatic organisms. This is due to changes in its water quality, which may be a result of soil erosion with accompanying chemicals from pesticide residues in sloping areas devoted to agriculture.

Another situation to reckon with is the intensive quarrying in the river

which has resulted to its shallowing and widening. With increased sedimentation, water meanders to other surfaces. The danger of flooding is thus so evident. Worse, the intensive quarrying activities near a bridge in Tipolo is courting a disaster to the bridge.

Farming near the river banks are also uncontrolled and tolerated, resulting in soil erosion and siltation. This has also brought about the dislocation of the sanctuaries of birds and other wildlife whose habitat has been established near river banks. However, the most serious effect of land use in areas near the river banks is the destruction of the aquatic ecosystem brought about by the physico-biological and chemical changes in water quality and the destruction of the habitat of aquatic organisms.

The Langaran River has influence on the upland, lowland and coastal ecosystems. As the river flows from higher elevation areas to the coastal region, its effect on the biodiversity of these areas is also evident. *"Reversing land degradation in the Langaran River watershed"* is thus one of the major research themes suggested.

Forest Sub-ecosystem. In all barangays, *mahogany* and *gmelina* are the main reforestation species. In Siloy, a 50-hectare reforestation area of these species is located at the foot of Mt. Amparo. The local people have also cleared the foot of the forest by kaingin thereby endangering the habitat of *kapa-kapa (Medinella magnifica)* and primitive and rare plants like *Psilotum complanatum* and *Tmesipteris lanceolata*.

The scenario at Mt. Amparo and its environs offers an ideal opportunity for biodiversity research because of its rich biological resources which are now threatened. The encroachment of the indigenous groups and other migrants into Mt. Amparo have resulted in the massive destruction of biodiversity resources, especially forest resources and wildlife. Land use practices in the area do not favor soil conservation in hilly and rolling lands. Soil erosion is evident and fertility of the soil is very low.

The Subanens living in the area can be tapped to reinforce conservation activities through their indigenous knowledge systems (IKS). They are engaged in biological farming, such as the biological control of pests where specific insects are utilized to devour harmful agricultural pests. They also practice organic farming which avoids the use of chemicals and fertilizers that could adversely affect the survival of plant and animal life, and even aquatic resources, as these chemicals flow into the Dioyo River.

Another research theme suggested is therefore *"Conserving biodiversity*

'hotspots' in Mt. Amparo and its environs through appropriate land use practices". Biodiversity research activities in the area would look into IKS that could support efforts at biodiversity conservation, such as preserving trees with medicinal values, and conserving wildlife and their corridors.

As farmers remain idle in-between planting and harvesting activities, the generation of livelihood activities are envisioned to augment family income like establishment of a nursery for the reforestation project, plantation of medicinal and economic plants, and a tissue culture laboratory to mass propagate economically important plants.

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